



MachZ™ FailSafe™ Embedded PC-on-a Chip

Designed by the embedded world for the embedded world. The MachZ PC-on-a-chip was designed from the ground up to resolve the critical issues that can stand in the way of creating successful and reliable OEM products.

LOWEST BOM COST

Of prime importance in the design of any OEM product is the overall system cost in production. The ZF's architecture was created specifically to be the most cost-effective way of incorporating full PC functionality and compatibility in high volume OEM products. Designed from inception for use in cost-sensitive embedded systems, MachZ requires minimal external components.

It is the only device of its kind that makes possible the inclusion of the equivalent of a PC motherboard in OEM devices for a total Bill of Materials cost of as little as \$50. This includes the BIOS license and operating system!

LONG PRODUCT LIFE

Constant product redesign due to component obsolescence is eliminated by a five-year minimum availability guarantee. Unlike desktop products that constantly change at the whim of market conditions, this device was designed exclusively for the embedded market. The .25 micron technology is produced at world class, state of the art facilities assuring the highest quality and reliability.

SYSTEM LEVEL ARCHITECTURE

Designing a product with an embedded PC is not a trivial matter. The product architecture must be conceived of from the beginning as a system or delays in both software and hardware development is inevitable. PC compatibility issues (both hardware and software) must be carefully considered because the consequences of any incompatibility can manifest themselves as field failures.

MachZ incorporates the functionality of a PC motherboard with all the most common PC peripherals and a number of ZF proprietary enhancements developed exclusively for the embedded market. Ease of integration, reliability and FailSafe operation in harsh environments were the guiding factors in the design process.

- ◆ **Unequaled set of traditional PC H/W features**
- ◆ **Lowest BOM cost in embedded market for lowest OEM product cost**
- ◆ **Long product Life - .25 micron technology guarantees long-term availability - Produced at state of the art facilities**
- ◆ **System level architecture to minimize integration complexity**
- ◆ **Bundled S/W & Firmware - Full Embedded PC BIOS, Linux image and Real-Time O/S with Browser**
- ◆ **Patented ZF Embedded H/W and S/W features unique to embedded market**
- ◆ **Proven industry standard architecture completely implemented - No multiplexing**



BUNDLED S/W & FIRMWARE COMPLETES PC "SYSTEM"

Included in the price of every unit is a fully implemented embedded PC compatible BIOS, Linux image and Real-Time O/S with Browser. There are no licensing hassles, no porting, and no searching for drivers to support peripherals. Time-to-market is shortened and system reliability is increased.

PATENTED EMBEDDED FEATURES

FailSafe Boot ROM

Today the operating system in most devices utilizing computer intelligence resides in flash memory. The flash memory is also often used to store program data and other transient information. Under certain conditions power irregularities or other operating anomalies can corrupt the flash memory. The ZF FailSafe Boot ROM combined with the ZF Integrated BIOS allows total system recovery if such a corruption takes place. This can even be achieved remotely when no operator is in attendance.

ZF-Logic

As increasing numbers of everyday devices incorporate computer intelligence, the microprocessor architecture knowledge required by system designers becomes more demanding. ZF-Logic allows access to X86 system architecture with a minimal amount of high-level microprocessor experience. The result is shorter time-to-market cycles and more reliable products.

Z-tag - lowest cost Flash downloads

As the capacity of flash memory devices in which BIOS, operating system and application S/W is stored increases, the time required to program these devices can become a significant factor in the production cost of an end product. Z-tag allows this programming to be accomplished on-board in a fraction of the time. Transfer rates under Z-tag exceed 2,500,000 bits per second whereas typical transfer rates are only 19,200 bits per second. In a high-volume manufacturing environment a dramatic savings in programming time can be realized.

Dual Watchdog Timer

With both software and hardware control of the WDT event maximum protection from downtime losses is provided.

INDUSTRY STANDARD ARCHITECTURE COMPLETELY IMPLEMENTED

The PC is the architecture of choice for embedded applications because of ease of software development, low manufacturing system cost and fast time-to-market. If the embedded processor selected is not fully PC compatible all these key measures of success can be lost.

MachZ provides the ultimate combination of a high integration device at the lowest BOM cost in the industry without sacrificing full PC compatibility. There are no multiplexed signals, no missing interrupts, and a full complement of standard peripherals. It is the fastest, most cost-effective means of integrating full PC motherboard functionality in an OEM product.

A high speed 32 bit processor married to a superior SDRAM memory controller, a PCI expansion bus with an Ultra DMA IDE controller. A full ISA bus brings with it all the well-understood ISA devices to help solve many of the potential challenges unique to embedded applications. Enhanced with such ZF proprietary embedded features as FailSafe Boot ROM, the Z-tag interface, Dual Watchdog timer and ZF-Logic, integrated ISA bus decoding, MachZ allows for seamless and glueless system integration.

By combining the hardware and software needed to implement full PC compatibility in a single device, it lowers the exposure to development risks and significantly reduces time-to-market. This unique integrated design makes it ideal for applications that require computing intensive processes, low power consumption, high reliability and a small overall product size.

Since the MachZ is fully PC compatible you gain access to:

- ◆ Widest selection of hardware and software available.
- ◆ Proven architecture supported by hundreds of ISA, PCI, USB and I²C bus suppliers.
- ◆ Cost-effective, readily available development tools and operating systems.

INDUSTRY STANDARD X86 ARCHITECTURE

Processor Core

- ◆ 32 bit CPU core
- ◆ 133, 100, 66 and 33MHz operation
- ◆ 8K cache
- ◆ Floating point unit (FPU)
- ◆ Level one write back and write through cache support

DRAM Controller

- ◆ SDRAM (Synchronous DRAM) support
- ◆ Memory configurations to a 32 bit or 16 bit data interface in up to four memory banks
- ◆ 16/64/128 Mb symmetric or asymmetric SDRAM
- ◆ Maximum 256MB memory space

PCI Host Bridge controller

- ◆ 32 bit 33MHz rev. 2.1 compliant
- ◆ Bus speed is system clock or system clock/2.
- ◆ Burst transfers up to 120MB per second.
- ◆ South Bridge and external masters can access SDRAM connected to DRAM controller
- ◆ Supports up to three external PCI masters

Full ISA Bus

- ◆ Full set of ISA bus signals
- ◆ Complete IRQ set
- ◆ 16 and 8 bit DMA support
- ◆ 16 and 8 bit device support; full set of control lines

IDE Controller

- ◆ Support two channels with 3 devices
- ◆ PCI master burst reads and writes
- ◆ Ultra DMA (ATA-4) support
- ◆ Programmed IO (PIO) Modes 0-4 support

Universal Serial Bus (USB)

- ◆ Two independent USB interfaces which are Open Host Controller (Open HCL) compliant
- ◆ Second generation proven core design

Integrated Super IO

- ◆ Floppy disk controller
- ◆ Two standard serial ports
- ◆ Infrared communications port off one of the serial ports
- ◆ IEEE 1284 compatible parallel port
- ◆ Real-time clock
- ◆ 8042 AT keyboard and PS/2 mouse controller
- ◆ Access Bus interface compatible with SM Bus and I2C

AT Compatibility

- ◆ 8259A equivalent interrupt controllers
- ◆ 8254 equivalent timer
- ◆ 8237 equivalent DMA controllers
- ◆ Port A, B, and NMI logic

Power Management and GPIO

- ◆ I/O traps and idle timers for peripheral power mgmt.
- ◆ 8 GPIO's
- ◆ Wake-up on USB
- ◆ Keyboard / mouse activity detect for screen wake-up

Processor Interface

- ◆ Suspend clock protocol with connection through North Bridge
- ◆ NMI and maskable interrupt

Electrical Characteristics

- ◆ Dual voltage device
- ◆ 5V tolerant 3.3V I/O
- ◆ 2.5V core voltage

Power Consumption (estimated)

- ◆ 33MHz 0.8W, 66MHz 1.6W, 100MHz 2.2W, 133MHz 2.8W

Mechanical / Environmental

- ◆ 33MHz, 66MHz, 100MHz (-40 to +85C) (estimated)
- ◆ 133MHz (0-70C)
- ◆ Package: 388-pin Plastic Ball Grid Array, 35mm x 35mm

Embedded Features:

FailSafe Boot ROM

- ◆ On-chip code
- ◆ Allows execution of multiple instruction sets: DRAM clear, Flash erase, executable load and run, etc
- ◆ Provides permanent and fail-safe mechanism to update S/W under all adverse operating conditions

ZF-Logic

- ◆ PWM generator
 - Programmable Pulse Width Modulator output (100-100KHz)
 - Free running
 - Ideal for switching power supplies or LCD back-light inverter control
- ◆ External memory decode logic
 - Four memory mapped chip selects
 - Base address and size registers
 - Automatic overlap check
- ◆ General Purpose Chip Select mapper
 - Four I/O mapped chip selects
 - Base address and size registers
 - Automatic overlap check
- ◆ Boot strap register (DIP switches)
 - Allows customized booting conditions

Z-tag Interface

- ◆ High speed interface to download S/W
- ◆ Uses floppy interface when "Drive Select" signal is inactive
- ◆ Communication protocol is compatible with standard serial EEPROM devices
- ◆ Can be driven by standard parallel port.

ZF-Dwdt

- ◆ Embedded application Dual Watchdog Timer (WDT) with SW and HW control of the WDT event
- ◆ 8 bit counter (1-256 sec) primary watchdog connected to SW IRQ/NMI/SMI reset by Watch Dog Timer Input (WDI)
- ◆ Second 8 bit counter (1-256ms) output connected to H/W reset line enabled by primary counter output
- ◆ Counter values can be read anytime
- ◆ Counter enable and disable control

Software Included

- ◆ Full embedded PC BIOS
- ◆ Linux image supporting all MachZ features
- ◆ Planetweb O/S with browser

Software Compatibility

- ◆ Linux
- ◆ DOS
- ◆ Most PC compatible RTOSes
- ◆ WinCE™, Windows™ 9x, and Windows NT™

A TRUE PC "SYSTEM"-ON-A-CHIP

system: an assemblage or combination of things or parts forming a complex or unitary whole¹

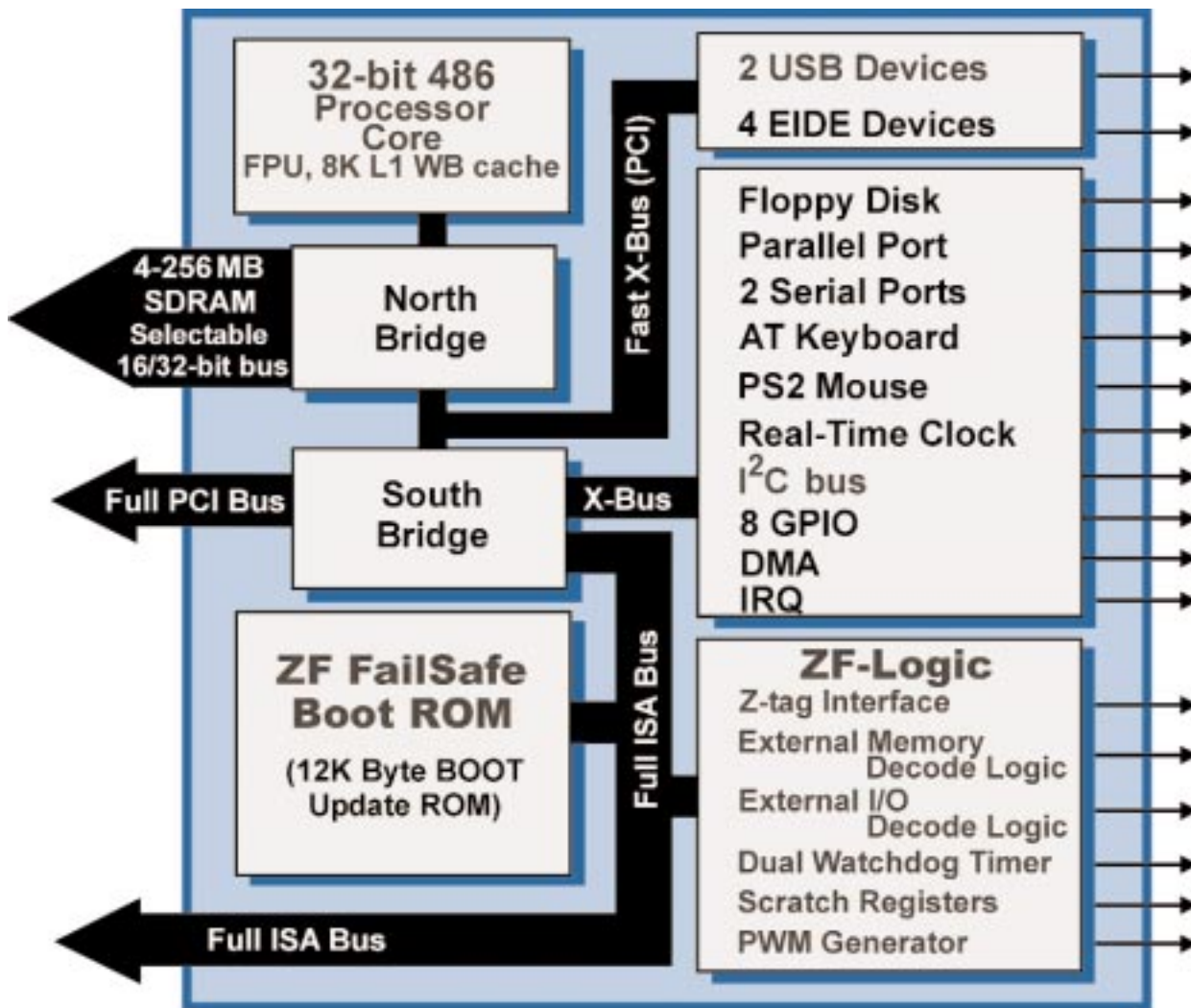
IT'S NOT A SYSTEM UNTIL IT BOOTS

No processor, no matter what the level of integration is a system until it boots. If it doesn't come with a fully implemented PC BIOS and an operating system it won't run.

MachZ is the first and only System-on-a-Chip that includes the BIOS and operating system software combined with an internal FailSafe boot ROM that insures that your system will always be accessible.

SOFTWARE COMPATIBILITY

The MachZ PCe is fully compatible with all standard PC software. It will run any standard operating system capable of running on a fully compatible PC with FPU such as Linux, DOS, many RTOSs, and WinCE, Windows 9x, and Windows NT.



¹ The Random House Dictionary of the English Language
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